Amendments to the Claims

The listing of claims will replace all prior versions, and listings of claims in the application.

1.   (Currently Amended) A charger ~~charging equipment~~ for a secondary battery, comprising:

a voltage increment means for incrementing a check voltage by a preset pitch of voltage, the incrementing being from a lowest check voltage lower than a rated equilibrium voltage at full charge of any secondary battery of all kinds to be charged;

a charge voltage supply means for supplying special charging voltage [[that]], wherein the special charging voltage is higher than the rated equilibrium voltage at full charge of any secondary battery of all kinds to be charged, but does not enter an irreversible chemical reaction region;

a switch means for switching voltage applied to the secondary battery between a voltage selected from the group consisting of the special charging voltages supplied by the charge voltage supply means, and the check voltage supplied by the voltage increment means;

a current detection means for detecting an electric current flowing through the secondary battery during application of the check voltage to the secondary battery;

a first judging means for judging whether the electric current detected by the current detection means is smaller than or as large as a preset standard electric current for judging; and

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a second judging means for judging whether a time required for a period from the last affirmative judgment judged by the first judging means to the present affirmative judgment judged by the first judging means is larger than r ~~(r is a real number not smaller than 1)~~ times as large as a time required for a period from the before-last affirmative judgment judged by the first judging means to the last affirmative judgment judged by the first judging means, <u>where r is a real number not smaller than 1,</u>

wherein ~~charge~~ <u>charging</u> of the secondary battery is controlled according to <u>the following</u> ~~first to seventh~~ steps ~~as follows~~:

wherein <u>in</u> the first step[[, where]] the lowest check voltage is applied to the secondary battery for a short time, and the current detection means detects electric current flowing through the secondary battery during the short time;

wherein <u>in</u> the second step[[, where]] the first judging means judges the detected electric current so as to execute a command selected from the group consisting of:

passing to the third step when the electric current is larger than the standard electric current for judging, and

jumping to the fourth step when the electric current is smaller than or as large as the standard electric current for judging;

wherein <u>in</u> the third step[[, where]] the switch means switches the applied voltage to the special charging voltage, the special charging voltage [[is]] <u>being</u> applied to the secondary battery for a predetermined time,

and then the switch means switches the applied voltage to the lowest check

voltage, and a step returns to the first step;

wherein in the fourth step[[, where]] the voltage increment

means sets a renewed check voltage made by the present check voltage plus

the pitch of voltage;

wherein in the fifth step[[, where]] the switch means switches

the applied voltage to the special charging voltage, the special charging

voltage [[is]] being applied to the secondary battery for a predetermined time,

and then the switch means switches the applied voltage to the renewed check

voltage, the renewed check voltage is applied to the secondary battery for a

short time, [[and]] wherein the current detection means detects electric current

flowing through the secondary battery during the application of the renewed

check voltage to the secondary battery;

wherein in the sixth step[[, where]] the first judging means

judges the detected electric current so as to execute a command selected from

the group consisting of:

returning to the fifth step when the electric current is

larger than the standard electric current for judging, and

passing to the seventh step when the electric current is

smaller than or as large as the standard electric current for judging; and

wherein in the seventh step[[, where]] the second judging

means judges the time required for the period from the last affirmative

judgment judged by the first judging means to the present affirmative

judgment judged by the first judging means so as to execute a command

selected from the group consisting of:

returning to the fourth step when the time required for

the period from the last affirmative judgment judged by the first judging

means to the present affirmative judgment judged by the first judging means is

not larger than *r* times as large as the time required for the period from the

before-last affirmative judgment judged by the first judging means to the last

affirmative judgment judged by the first judging means, and ~~outputs~~

outputting a signal to stop charging when the time

required for the period from the last affirmative judgment judged by the first

judging means to the present affirmative judgment judged by the first judging

means is larger than *r* times as large as the time required for the period from

the before-last affirmative judgment judged by the first judging means to the

last affirmative judgment judged by the first judging means.

2.   (Currently Amended) The charger ~~charging equipment~~ for a

secondary battery according to claim 1, wherein, when the signal to stop

charging is outputted at the seventh step, the switch means switches the

applied voltage to the special charging voltage, the special charging voltage

[[is]] being applied to the secondary battery for a second predetermined time,

and then charge of the secondary battery is finished.

3.   (Currently Amended) The charger ~~charging equipment~~ for a

secondary battery according to claim 1, wherein the required time is measured

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by counting the number of switchings of the applied voltage to the check

voltage by the switch means.

4.   (Currently Amended) The charger ~~charging equipment~~ for a

secondary battery according to any of claims claim 1, the voltage increment

means comprising:

a microcomputer for outputting a pulse wave of pulse width

$c \cdot w$ from one predetermined output terminal ~~on the premise that,~~ wherein w is

a time having a length of one of n ~~(n is an integer not smaller than 2)~~ equal

divisional parts of one cycle of the pulse wave, wherein n is an integer not

smaller than 2, and c ~~(c=1,2,•••,n)~~ is a variable represented as an integer

between 1 and n.

a supremum and infimum voltage setting circuit for inverting

the maximum and the minimum [[of]] amplitude of the pulse wave outputted

from [[the]] an output terminal to each other, and setting the maximum [[of]]

amplitude of the inverted pulse wave as a supremum voltage and the minimum

[[of]] amplitude of the inverted pulse wave as an infimum voltage; and

an arithmetic circuit for averaging the voltage of the pulse wave

outputted from the supremum and infimum voltage setting circuit, and

outputting a value of voltage made by a base voltage minus the just averaged

voltage,

wherein the ~~valuable~~ variable c in the microcomputer is

incremented, so that the value of voltage outputted from the arithmetic circuit

is incremented by the pitch of voltage.

5.   (Currently Amended) The <u>charger</u> ~~charging equipment~~ for a secondary battery according to claim 1, the voltage increment means comprising:

a microcomputer for outputting a pulse wave of pulse width $c{\cdot}w$ from one predetermined output terminal<u>, wherein</u> ~~on the premise that~~ w is a time having a length of one of n ~~(n is an integer not smaller than 2)~~ equal divisional parts of one cycle of the pulse wave, <u>wherein n is an integer not smaller than 2,</u> and c ~~(c=1,2,$\cdots$,n)~~ is a variable <u>represented as an integer between 1 and n</u>;

a supremum and infimum voltage setting circuit for setting the maximum [[of]] amplitude of the pulse wave outputted from [[the]] <u>an</u> output terminal as <u>a</u> supremum voltage and the minimum [[of]] amplitude of the pulse wave as <u>an</u> infimum voltage; and

an arithmetic circuit for averaging the voltage of the pulse wave outputted from the supremum and infimum voltage setting circuit, and outputting a value of voltage made by <u>a</u> base voltage plus the just averaged voltage,

wherein the ~~valuable~~ <u>variable</u> c in the microcomputer is incremented, so that the value of voltage outputted from the arithmetic circuit is incremented by the pitch of voltage.

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6.   (Currently Amended) The <u>charger</u> ~~charging equipment~~ for a secondary battery according to claim 1, the voltage increment means comprising:

a microcomputer for outputting a pulse wave of pulse width $c \cdot w$ from one predetermined output terminal on the premise that w is a time having a length of one of n ~~(n is an integer not smaller than 2)~~ equal divisional parts of one cycle of the pulse wave, <u>where n is an integer not smaller than 2,</u> and c ~~(c=1,2,•••,n)~~ is a variable <u>represented as an integer between 1 and n</u>;

a supremum and infimum voltage setting circuit for inverting the maximum and the minimum [[of]] amplitude of the pulse wave outputted from [[the]] <u>an</u> output terminal to each other, and setting the maximum [[of]] amplitude of the inverted pulse wave as <u>a</u> supremum voltage and the minimum [[of]] amplitude of the inverted pulse wave as <u>an</u> infimum voltage; and

an arithmetic circuit for averaging the voltage of the pulse wave outputted from the supremum and infimum voltage setting circuit, and outputting a value of voltage made by <u>a</u> base voltage plus the just averaged voltage,

wherein the ~~valuable~~ <u>variable</u> c in the microcomputer is ~~decremented~~ <u>decreased</u>, so that the value of voltage outputted from the arithmetic circuit is incremented by the pitch of voltage.

7.   (Currently Amended) The <u>charger</u> ~~charging equipment~~ for a secondary battery according to claim 1, the voltage increment means comprising:

a microcomputer for outputting a pulse wave of pulse width

$c \cdot w$ from one predetermined output terminal on the premise that w is a time

having a length of one of n ~~(n is an integer not smaller than 2)~~ equal divisional

parts of one cycle of the pulse wave, <u>where n is an integer not smaller than 2,</u>

and c ~~(e=1,2,•••,n)~~ is a variable <u>represented as an integer between 1 and n</u>;

a supremum and infimum voltage setting circuit for setting the

maximum [[of]] amplitude of the pulse wave outputted from [[the]] <u>an</u> output

terminal as <u>a</u> supremum voltage and the minimum [[of]] amplitude of the

pulse wave as <u>an</u> infimum voltage; and

an arithmetic circuit for averaging the voltage of the pulse wave

outputted from the supremum and infimum voltage setting circuit, and

outputting a value of voltage made by <u>a</u> base voltage minus the just averaged

voltage,

wherein the ~~valuable~~ <u>variable</u> c in the microcomputer is

~~decremented~~ <u>decreased</u>, so that the value of voltage outputted from the

arithmetic circuit is incremented by the pitch of voltage.

8.   (Currently Amended) The <u>charger</u> ~~charging equipment~~ for a

secondary battery according to claim 2, wherein the required time is measured

by counting the number of switching<u>s</u> of the applied voltage to the check

voltage by the switch means.

9.   (Currently Amended) The charger ~~charging equipment~~ for a secondary battery according to claim 2, the voltage increment means comprising:

a microcomputer for outputting a pulse wave of pulse width $c \cdot w$ from one predetermined output terminal, wherein ~~on the premise that~~ w is a time having a length of one of n ~~(n is an integer not smaller than 2)~~ equal divisional parts of one cycle of the pulse wave, where n is an integer not smaller than 2, and c ~~(c=1,2,•••,n)~~ is a variable represented as an integer between 1 and n;

a supremum and infimum voltage setting circuit for inverting the maximum and the minimum [[of]] amplitude of the pulse wave outputted from [[the]] an output terminal to each other, and setting the maximum [[of]]amplitude of the inverted pulse wave as a supremum voltage and the minimum of amplitude [[of]] the inverted pulse wave as an infimum voltage; and

an arithmetic circuit for averaging the voltage of the pulse wave outputted from the supremum and infimum voltage setting circuit, and outputting a value of voltage made by a base voltage minus the just averaged voltage,

wherein the ~~valuable~~ variable c in the microcomputer is incremented, so that the value of voltage outputted from the arithmetic circuit is incremented by the pitch of voltage.

10.   (Currently Amended) The <u>charger</u> ~~charging equipment~~ for a secondary battery according to claim 3, the voltage increment means comprising:

a microcomputer for outputting a pulse wave of pulse width $c \cdot w$ from one predetermined output terminal<u>, wherein</u> ~~on the premise that~~ w is a time having a length of one of n ~~(n is an integer not smaller than 2)~~ equal divisional parts of one cycle of the pulse wave, <u>wherein n is an integer not smaller than 2,</u> and c ~~(c=1,2,•••,n)~~ is a variable<u> represented as an integer between 1 and n</u>;

a supremum and infimum voltage setting circuit for inverting the maximum and the minimum [[of]] amplitude of the pulse wave outputted from [[the]] <u>an</u> output terminal to each other, and setting the maximum [[of]] amplitude of the inverted pulse wave as <u>a</u> supremum voltage and the minimum [[of]] amplitude of the inverted pulse wave as <u>an</u> infimum voltage; and

an arithmetic circuit for averaging the voltage of the pulse wave outputted from the supremum and infimum voltage setting circuit, and outputting a value of voltage made by <u>a</u> base voltage minus the just averaged voltage,

wherein the ~~valuable~~ <u>variable</u> c in the microcomputer is incremented, so that the value of voltage outputted from the arithmetic circuit is incremented by the pitch of voltage.

11.   (Currently Amended) The <u>charger</u> ~~charging equipment~~ for a

secondary battery according to claim 2, the voltage increment means

comprising:

a microcomputer for outputting a pulse wave of pulse width

$c \cdot w$ from one predetermined output terminal<u>, wherein</u> ~~on the premise that~~ w is

a time having a length of one of n ~~(n is an integer not smaller than 2)~~ equal

divisional parts of one cycle of the pulse wave, <u>where n is an integer not</u>

<u>smaller than 2,</u> and c ~~(c=1,2,···,n)~~ is a variable<u> represented as an integer</u>

<u>between 1 and n</u>;

a supremum and infimum voltage setting circuit for setting the

maximum [[of]] amplitude of the pulse wave outputted from [[the]] <u>an</u> output

terminal as <u>a </u>supremum voltage and the minimum [[of]] amplitude of the

pulse wave as <u>an </u>infimum voltage; and

an arithmetic circuit for averaging the voltage of the pulse wave

outputted from the supremum and infimum voltage setting circuit, and

outputting a value of voltage made by <u>a </u>base voltage plus the just averaged

voltage,

wherein the ~~valuable~~ <u>variable</u> c in the microcomputer is

incremented, so that the value of voltage outputted from the arithmetic circuit

is incremented by the pitch of voltage.

12. (Currently Amended) The <u>charger</u> ~~charging equipment~~ for a

secondary battery according to claim 3, the voltage increment means

comprising:

a microcomputer for outputting a pulse wave of pulse width

$c \cdot w$ from one predetermined output terminal, wherein ~~on the premise that~~ w is

a time having a length of one of n ~~(n is an integer not smaller than 2)~~ equal

divisional parts of one cycle of the pulse wave, where n is an integer not

smaller than 2 and c ~~(c=1,2,•••,n)~~ is a variable represented as an integer

between 1 and n;

a supremum and infimum voltage setting circuit for setting the

maximum [[of]] amplitude of the pulse wave outputted from [[the]] an output

terminal as a supremum voltage and the minimum [[of]] amplitude of the

pulse wave as an infimum voltage; and

an arithmetic circuit for averaging the voltage of the pulse wave

outputted from the supremum and infimum voltage setting circuit, and

outputting a value of voltage made by a base voltage plus the just averaged

voltage,

wherein the ~~valuable~~ variable c in the microcomputer is

incremented, so that the value of voltage outputted from the arithmetic circuit

is incremented by the pitch of voltage.

13.   (Currently Amended) The charger ~~charging equipment~~ for a

secondary battery according to claim 2, the voltage increment means

comprising:

a microcomputer for outputting a pulse wave of pulse width

$c \cdot w$ from one predetermined output terminal on the premise that w is a time

having a length of one of n ~~(n is an integer not smaller than 2)~~ equal divisional

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parts of one cycle of the pulse wave, <u>where *n* is an integer not smaller than 2</u> and *c* <s>(*c*=1,2,•••,*n*)</s> is a variable <u>represented as an integer between 1 and *n*</u>;

a supremum and infimum voltage setting circuit for inverting the maximum and the minimum [[of]] amplitude of the pulse wave outputted from [[the]] <u>an</u> output terminal to each other, and setting the maximum [[of]] amplitude of the inverted pulse wave as <u>a</u> supremum voltage and the minimum of amplitude of the inverted pulse wave as <u>an</u> infimum voltage; and

an arithmetic circuit for averaging the voltage of the pulse wave outputted from the supremum and infimum voltage setting circuit, and outputting a value of voltage made by <u>a</u> base voltage plus the just averaged voltage,

wherein the <s>valuable</s> <u>variable</u> *c* in the microcomputer is <s>decremented</s> <u>decreased</u>, so that the value of voltage outputted from the arithmetic circuit is incremented by the pitch of voltage.

14.   (Currently Amended) The <u>charger</u> <s>charging equipment</s> for a secondary battery according to claim 3, the voltage increment means comprising:

a microcomputer for outputting a pulse wave of pulse width *c*•*w* from one predetermined output terminal on the premise that w is a time having a length of one of *n* <s>(*n* is an integer not smaller than 2)</s> equal divisional parts of one cycle of the pulse wave, <u>where *n* is an integer not smaller than 2</u> and *c* <s>(*c*=1,2,•••,*n*)</s> is a variable<u> represented as an integer between 1 and *n*</u>;

a supremum and infimum voltage setting circuit for inverting

the maximum and the minimum of amplitude [[of]] the pulse wave outputted

from [[the]] an output terminal to each other, and setting the maximum [[of]]

amplitude of the inverted pulse wave as a supremum voltage and the minimum

of amplitude of the inverted pulse wave as an infimum voltage; and

an arithmetic circuit for averaging the voltage of the pulse wave

outputted from the supremum and infimum voltage setting circuit, and

outputting a value of voltage made by a base voltage plus the just averaged

voltage,

wherein the valuable variable *c* in the microcomputer is

decremented, so that the value of voltage outputted from the arithmetic circuit

is incremented by the pitch of voltage.

15.   (Currently Amended) The charger charging equipment for a

secondary battery according to claim 2, the voltage increment means

comprising:

a microcomputer for outputting a pulse wave of pulse width

c•w from one predetermined output terminal on the premise that *w* is a time

having a length of one of *n* (n is an integer not smaller than 2) equal divisional

parts of one cycle of the pulse wave, where *n* is an integer not smaller than 2,

and *c* (c=1,2,•••,n) is a variable represented as an integer between 1 and *n*;

a supremum and infimum voltage setting circuit for setting the

maximum [[of]] amplitude of the pulse wave outputted from [[the]] an output

terminal as a̲ supremum voltage and the minimum [[of]] amplitude of the
pulse wave as a̲n̲ infimum voltage; and

an arithmetic circuit for averaging the voltage of the pulse wave
outputted from the supremum and infimum voltage setting circuit, and
outputting a value of voltage made by a̲ base voltage minus the just averaged
voltage,

wherein the ~~valuable~~ variable c in the microcomputer is
~~decremented~~ decreased̲, so that the value of voltage outputted from the
arithmetic circuit is incremented by the pitch of voltage.

16.   (Currently Amended) The charger̲ ~~charging equipment~~ for a
secondary battery according to claim 3, the voltage increment means
comprising:

a microcomputer for outputting a pulse wave of pulse width
$c{\bullet}w$ from one predetermined output terminal on the premise that w is a time
having a length of one of n ~~(n is an integer not smaller than 2)~~ equal divisional
parts of one cycle of the pulse wave, where n is an integer not smaller than 2,̲
and c ~~(c=1,2,•••,n)~~ is a variable represented as an integer between 1 and n̲;

a supremum and infimum voltage setting circuit for setting the
maximum [[of]] amplitude [[of]] the pulse wave outputted from [[the]] a̲n̲
output terminal as a̲ supremum voltage and the minimum of amplitude of the
pulse wave as a̲n̲ infimum voltage; and

an arithmetic circuit for averaging the voltage of the pulse wave
outputted from the supremum and infimum voltage setting circuit, and

outputting a value of voltage made by a base voltage minus the just averaged

voltage,

wherein the ~~valuable~~ variable c in the microcomputer is

~~decremented~~ decreased, so that the value of voltage outputted from the

arithmetic circuit is incremented by the pitch of voltage.